Rio Grande Canalization Project
Environmental Impact Statement (EIS)

Discussion Workshop
Modified Restoration Alternative

October 22, 2001

Workshop Agenda

- Modified Alternative Description
  - **Formulation**
  - **Description**
  - **Implementation**
- Review of Proposed Measures
- Open discussion
- Agreements

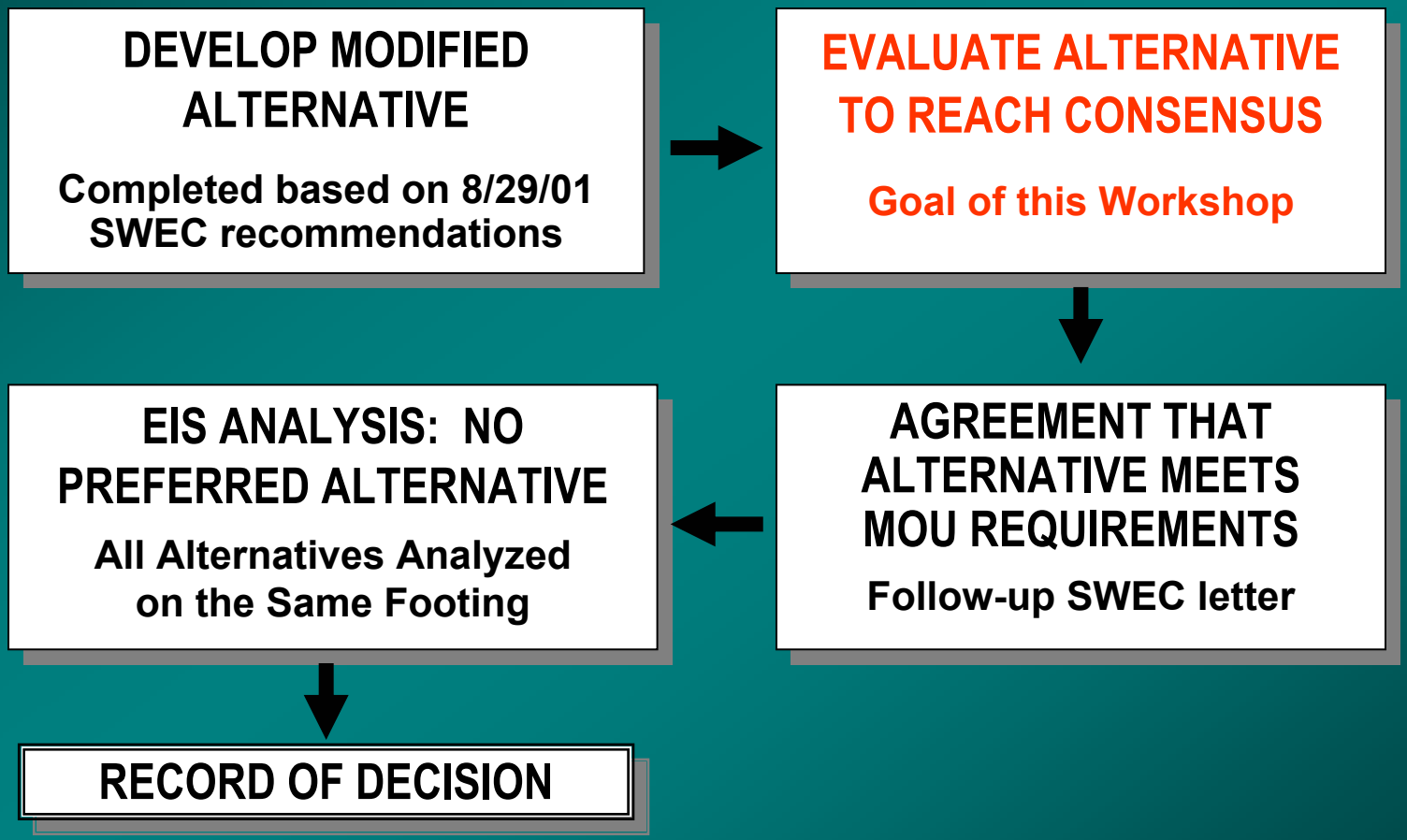
Key Modifications

Previous Formulation	Modified Formulation
USIWC PRIMARY ROLE Funding and implementing most of the proposed actions	Coordinate program and implement actions within ROW. Funding by other organizations
FLOOD CONTROL DEFICIENCIES Addressed by rehabilitation of levee existing system	Addressed at selected locations by non-structural methods
CABALLO DAM RELEASES No control over amount or timing of releases	Water releases and distribution partially modified by agreement with irrigation districts
WATER DELIVERY Continue channel maintenance to assure efficient water delivery	Allows inefficiencies in delivery (losses are accounted and paid for)

Key Modifications (cont.)

PREVIOUS FORMULATION	MODIFIED FORMULATION
BASIS FOR RESTORATION Direct intervention (opening of old meanders, bank shaving, pole planting, etc.)	Sustainability of stream function (i.e. establishing bosque and re-shaping main channel by overbank flooding)
BOSQUE DEVELOPMENT Emphasis on acquisition of land adjacent to remnant bosques	Land/easement acquisition primarily for development of riparian corridor
ENHANCEMENTS At selected locations, mostly within right-of-way	Actions may extend significantly beyond ROW (mostly for flood easements and erosion control)
GEOGRAPHICAL COVERAGE Environmental enhancements at individual locations or clusters	Restoration along a 40-mile reach (Rincon Valley to Seldon Canyon)

EIS Completion Path



Description of Alternative
Adopted Methodology

Approach as suggested by SWEC:

1. Define restoration goals and requirements
2. Identify potential function of restored stream within ROW
3. Evaluate flood control in a restoration context

Restoration Goals:

Re-establish riparian bosque

Diversify aquatic habitat

Partially restore stream morphology and function to pre-Canalization conditions

Description of Alternative

Goals and Restoration Requirements

1. **Diversification of Aquatic Habitat**
   - Low velocity water for fish reproduction
   - Maintain arroyo habitat
2. **Re-establishing Riparian Bosque**
   - Initial planting in floodable areas
   - Flood pulses to sustain vegetation
3. **Partial Morphology and Function Restoration**
   - Reopening of major meanders
   - Non-structural flood control

Selected Restoration Area

Rincon Valley to Seldon Canyon

(Upper 40 miles of Canalization Project)

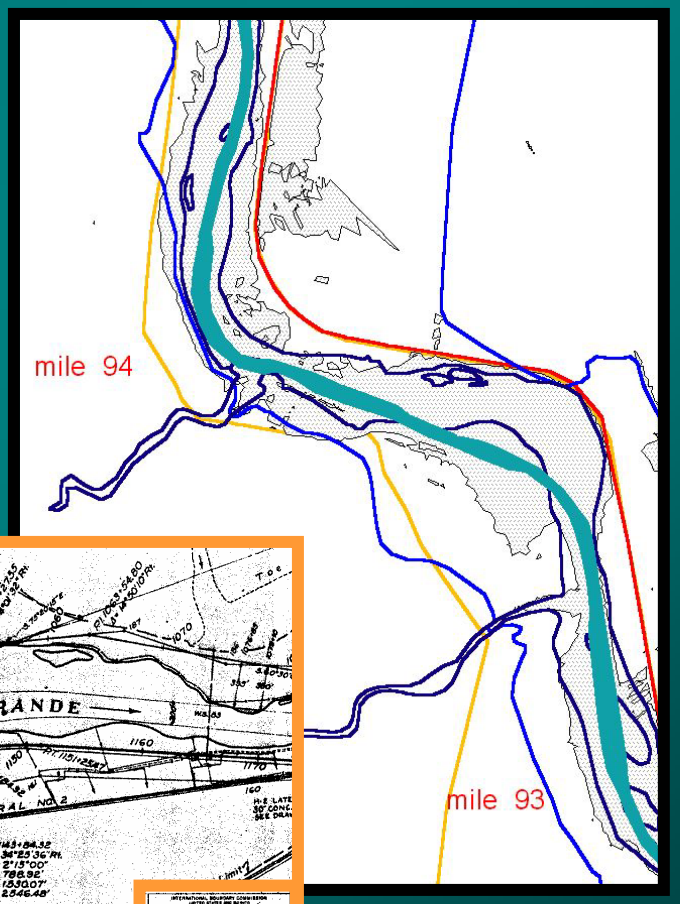
- **Use of flood pulses is practical**
- **Opportunities for non-structural flood control**
- **Multiple enhancement sites (arroyos, bosques)**
- **Location of several cut meanders**
- **Least developed area**
- **Relatively unconfined segment**

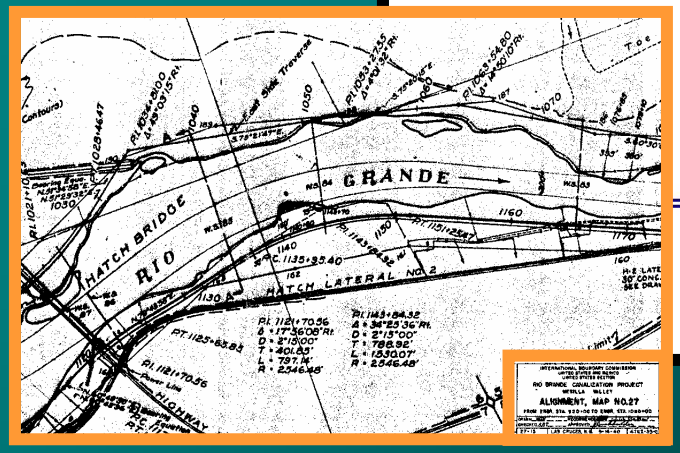
Goal 1: Diversify Aquatic Habitat

Historical Analysis

Features Identified from Pre-Canalization Drawings

- Streambed layout
- Arroyo modifications
- Cut meanders
- Historical flood limits



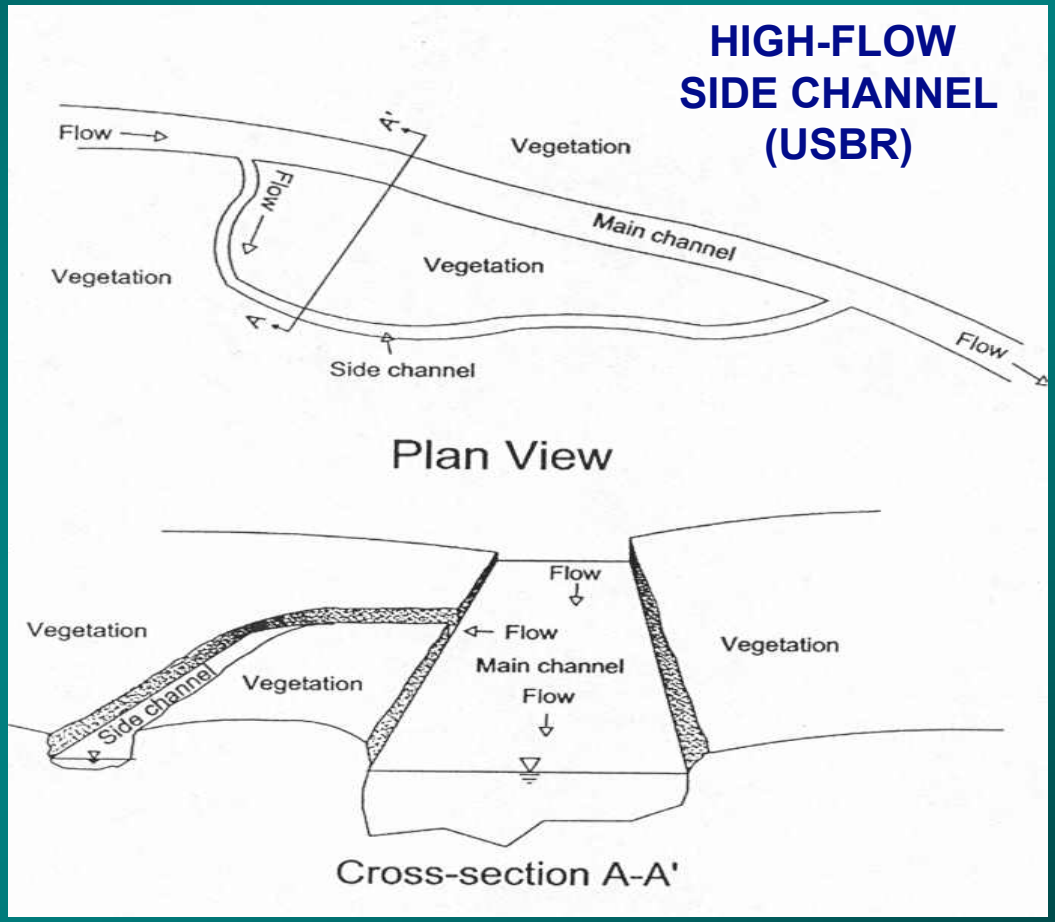


Goal1: Diversify Aquatic Habitat

Rehabilitation Options

Example Technique

HIGH-FLOW SIDE CHANNEL (USBR)

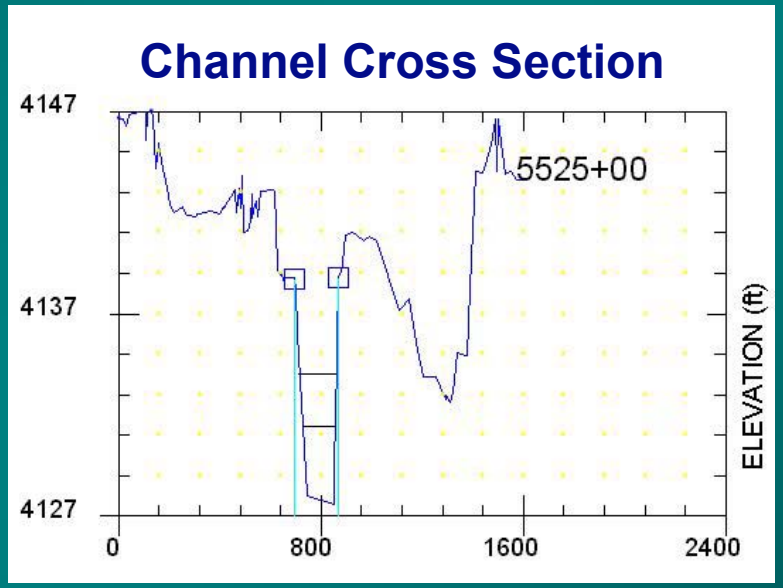


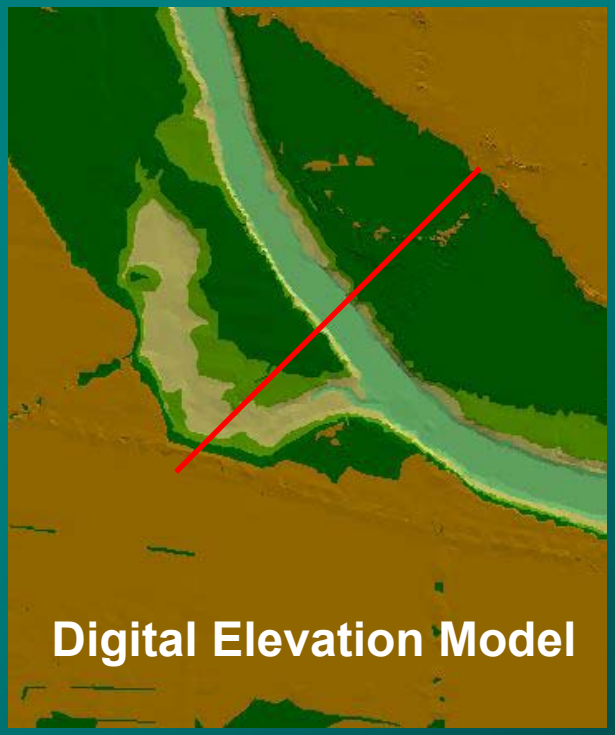
Goal1: Diversify Aquatic Habitat

Channel Cut Restoration

Upper Rincon Management Unit

Mile 104.5 (30 acres)





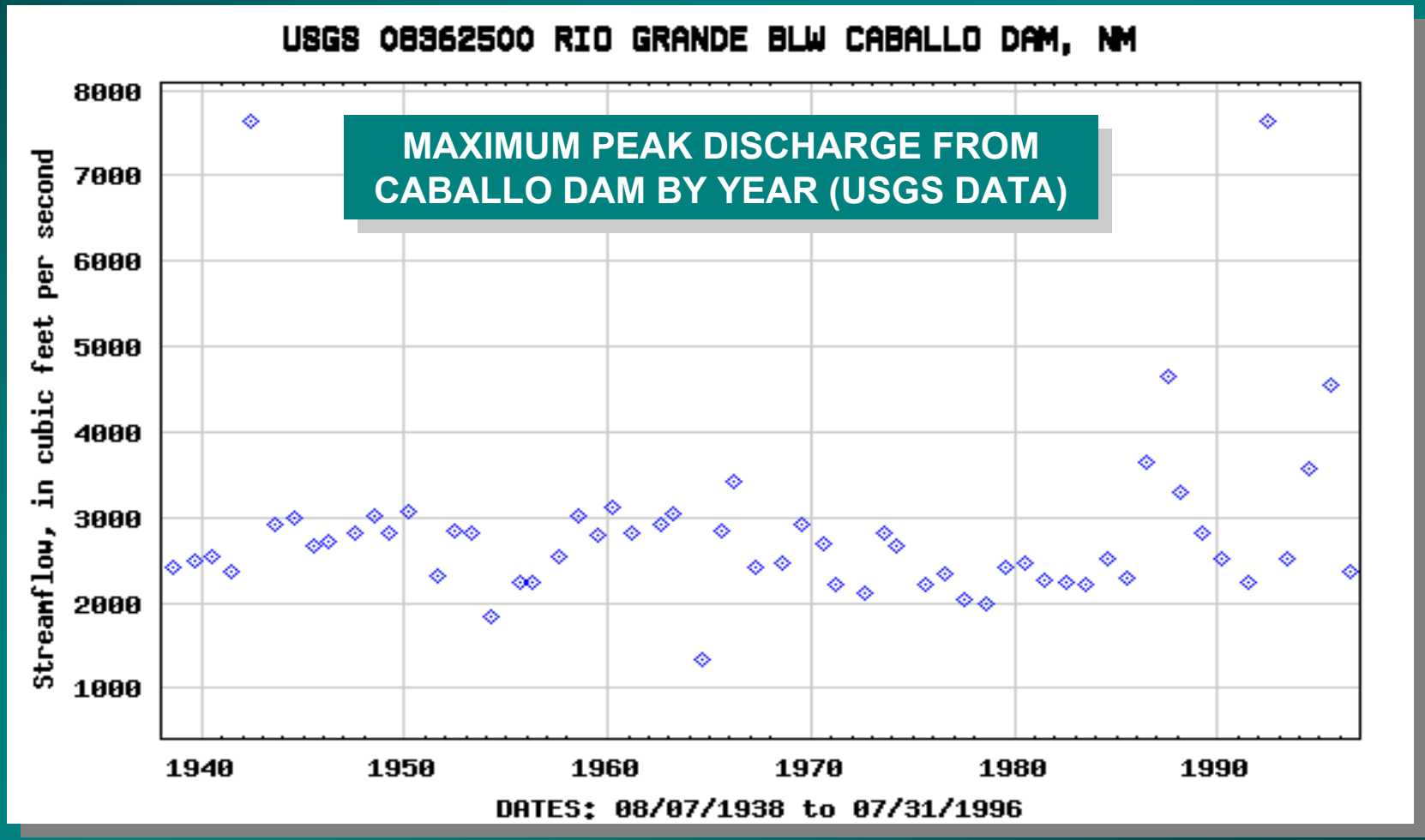
Goal 2: Reestablish Riparian Bosque
Flood Pulse Evaluation

Methodology:

- Defined range from historical flows
- Tested three discharge scenarios (HEC-RAS model, attenuated flow)
- Identified floodable area coverage (GIS mapping)
- Plotted suitable locations for

Goal 2: Reestablish Riparian Bosque

Historical Flow Data

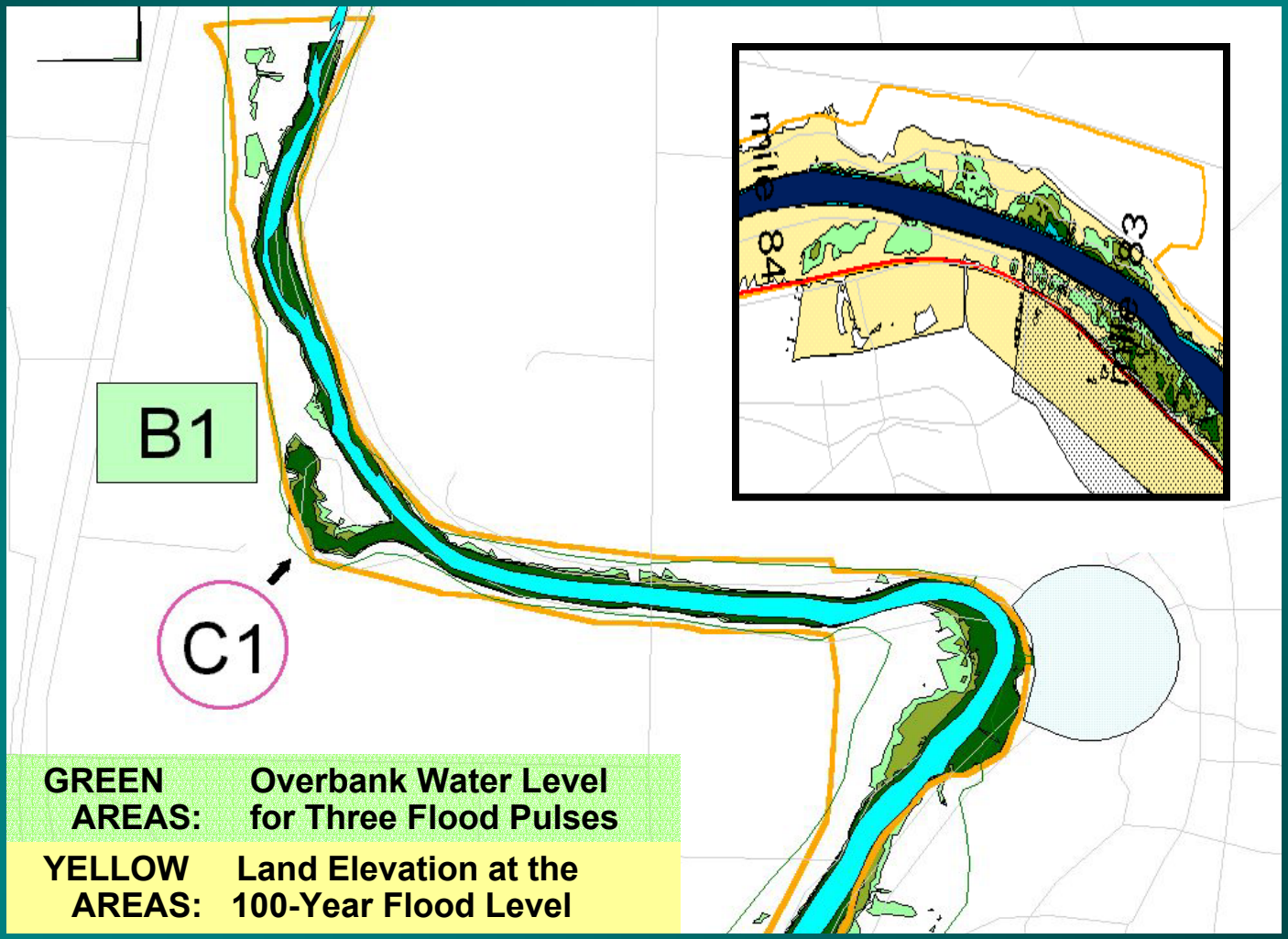


Goal 2: Reestablish Riparian Bosque
Pulse Flood Effectiveness

	River Mile	FLOODED AREA AT: 5,000 cfs	7,000 cfs	9,000 cfs
Percha Dam to Hatch Siphon	105-90	141	242	506
Downstream to Rincon Siphon	90-83	72	150	297
Downstream to Tonuco Bridge	83-74	320	474	642
Downstream to Leasburg Dam	74-63	634	905	1,206
	Acres:	1,167	1,771	2,651

Goal 2: Reestablish Riparian Bosque

Overbank Flood Condition



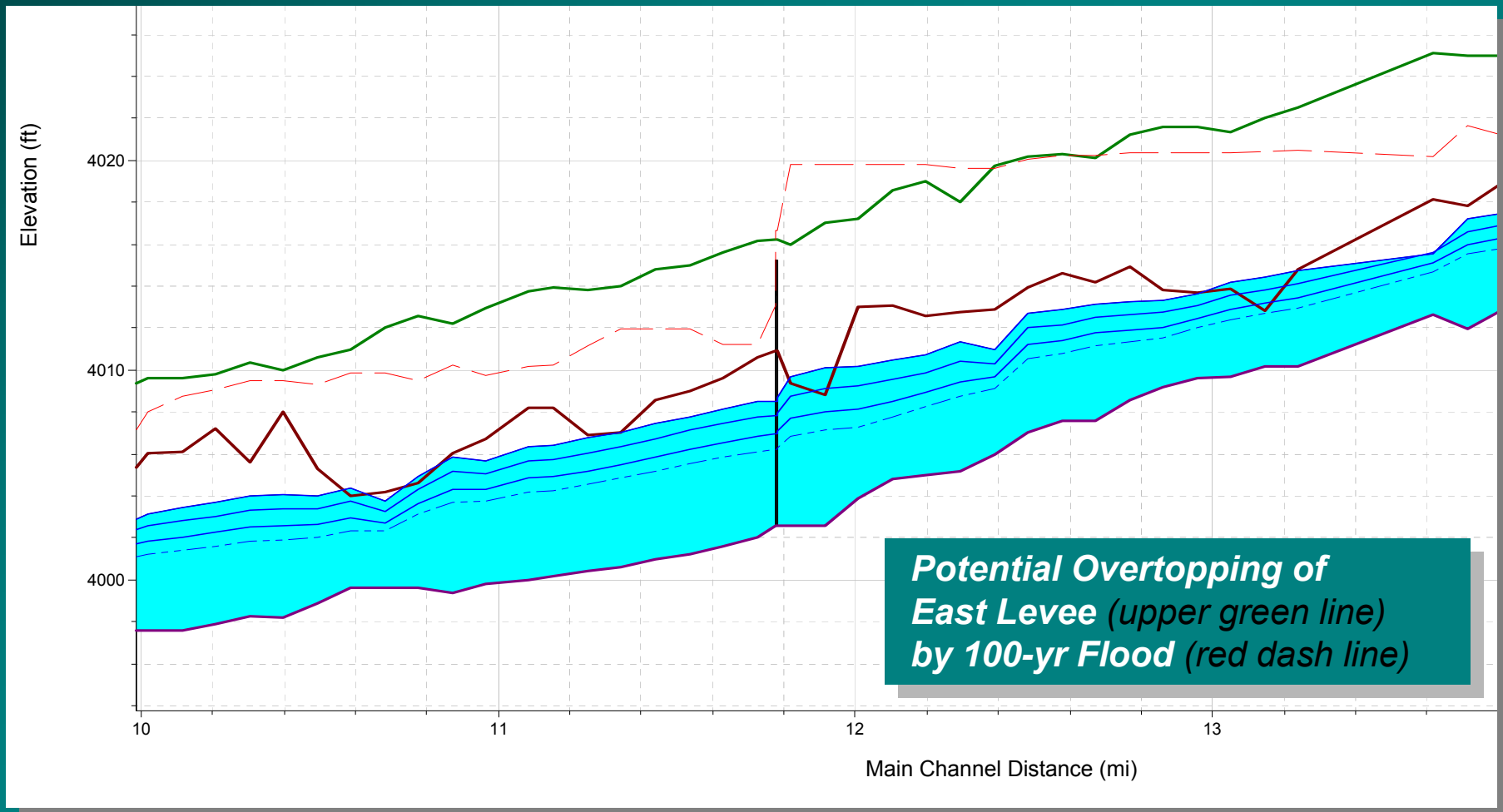
Goal 3:
Morphology and Function Restoration

Example Measures Incorporated into Alternative

- Non-structural flood control
  - Levee relocation or breaching
  - Flood easements acquisition
- Widening of pilot channel as a result of flood pulses and arroyo discharges
- Reopening of major meanders and development of split channels
- Bank stabilization by native vegetation

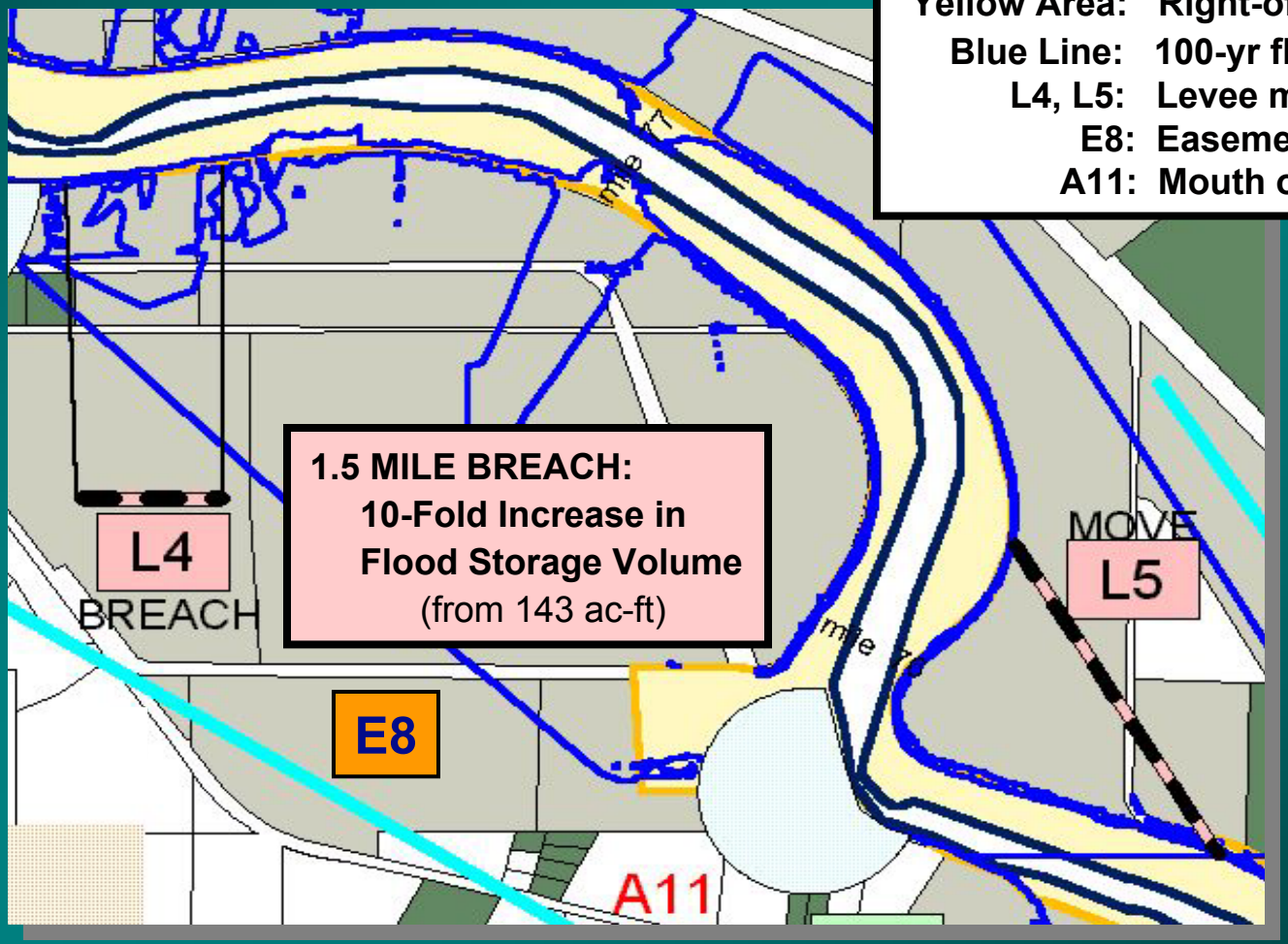
Goal 3: Morphology/Function Restoration

Flood Control Deficiencies



Goal 3: Morphology/Function Restoration

Potential Non-Structural Flood Control



PARSONS

Advantages/Benefits

Proposed Restoration Alternative

- **Over 40-mile stretch of potential restoration**
  (exceeds proposed target with better functionality**)**
- **Incorporates largest USIBWC land holdings and best enhancement opportunities**
  (Upper Rincon, Jaralosa and Crow Canyon)
- **Uses overbank flooding to sustain riparian vegetation**
- **Restoration progresses gradually as water is secured**
  (Allows monitoring of implemented measures and gradual optimization)

Advantages/Benefits

Proposed Restoration Alternative

- **Ensures adequate flood control and continued water deliveries** (with some efficiency losses)
- **Non-structural flood control methods address specific flood problem** (east levee, miles 70 to 75)
- **Located in least populated area** (facilitates easement and land acquisition)
- **Based on cooperation with irrigation districts**

Proposed Implementation:

- Coordination through Watershed Council
- Modified Management of USIBWC Lands
- Sediment Management
- Water Deliveries
- Flood Control
- Flood Irrigation

Limitations in Scope

Stream Morphology

- **Pre-Canalization conditions**
  (not prior to flow regulation at Elephant Butte Dam)
- **Partial restoration in the upper 40 miles**
  (structural flood control south of Leasburg Dam)
- **Limited levee breaching, relocation or removal**
  (areas with freeboard/structural deficiencies
  or to incorporate remnant bosques)

Limitations in Scope

Stream Function

- **Compensation required by loss in water delivery efficiency by channel modification**
  (widening, bank erosion at arroyos, new meanders)
- **Flood limits must be re-evaluated prior to land or easement acquisition**
  (flood limits are over-estimated by design storm and use of a model with no flow attenuation)

Limitations in Scope

Management

- **Emphasis on not-decommissioning farm land**
  (land acquisition limited to selected floodable areas with high potential to develop riparian bosque)
- **Current floodplain determines extent of easements**
  (limit other urban development with regulations)
- **USIBWC primary roles: coordinate program and implement measures within the ROW**
  (not to fund the program or to secure water rights)
- **Mowing maintained as required to control salt cedar**

Targeted Restoration Alternative

Agenda: Item 2

1) Modified Alternative Description
2) Review of Proposed Measures
3) Open discussion
4) Agreements

RIO GRANDE CANALIZATION PROJECT:
BASIS FOR REVISED RESTORATION ALTERNATIVE

PARSONS ENGINEERING SCIENCE
October 2001

NON-STRUCTURAL FLOOD CONTROL

Removal of the left levee from miles 87 to 97 was initially evaluated to reduce confinement of the stream and use of flood easements. This levee section did not appear to be well suited for non-structural flood control because:

- The stream is already unconfined in one margin.
- The river is largely retained within the channel, even at high flows.
- There are no levee deficiencies in terms of freeboard (from 8 to 12 ft. available).

The west side of the second levee downstream protects urban areas (Hatch), making its an unlikely candidate for modification. The left levee between miles 76 to 82, however, has better potential for partial levee removal or breaching because:

- Levees confine the stream in both margins.
- The segment is likely to have overbank flooding.
- The downstream levee appears to be deficient in terms of flood control, potentially justifying its modification and use of easements from a practical point of view.

OVERBANK FLOODING METHODOLOGY

Strong emphasis was placed on the development of riparian bosque as the main target of the restoration. A combined approach was proposed to accomplish this objective: agricultural flood irrigation (as currently used in Bosque del Apache) and flood pulses.

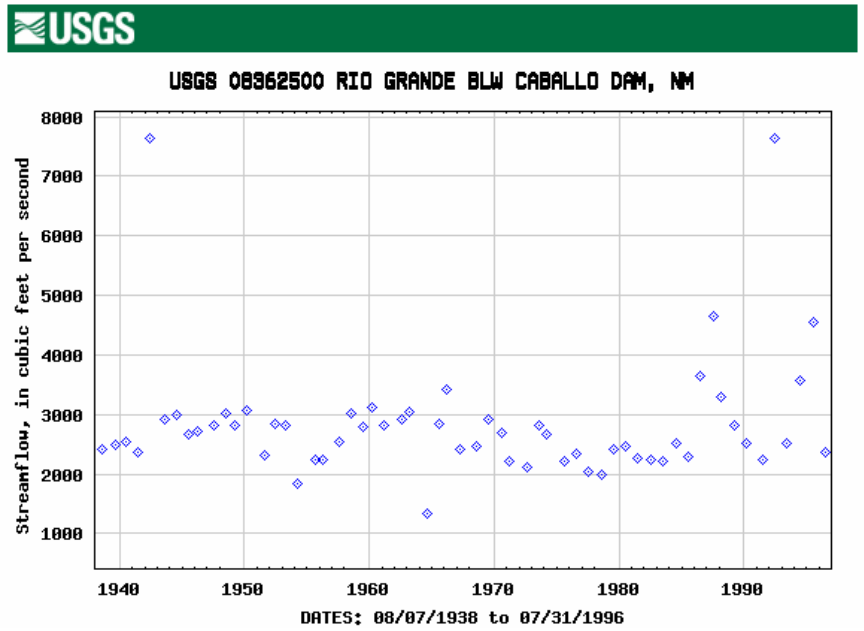
Flood Irrigation

Flood irrigation would play a key role in establishing and developing clusters of young bosques along a significant section of the project, north of Seldon Canyon. The task would start from Percha Dam and progress southward, as water becomes available. To obtain cooperation from the irrigation districts, water would be paid by increasing irrigation efficiency (and using the balance for the bosques), not by decommissioning farms (buying land or water rights).

Flood Pulses

Flood pulses would come into play latter in the process to support and expand already established tree clusters. Small pulses would be used initially for overbank flooding upstream, and increased in the long run as more water becomes available.

To estimate overbank flooding three pulses were modeled, assuming a release during no rainfall conditions in late spring: 5,000 cfs, 7,000 cfs and 9,000 cfs. These values were selected after review of peak discharges from Caballo Dam, as recorded by USGS (figure below). The data show peak values up to 7,500 cfs (recorded in July 1992).



PULSE FLOW CALCULATIONS

Pulse Flow Development

An attenuation factor of roughly 1.5 percent per mile was selected based on HEC-1 modeling data for the 100-year storm (Alternatives Formulation Report, March 2001, Table 8.1), as indicated below:

Mile	Length	Flow Reduction	Change (cfs)	Change (%)	Change per Mile
84.8		19,100			
81.8	3.0	18,300	800	4.2%	1.4%
80.4	1.4	17,700	600	3.3%	2.3%

Flows were then calculated for each pulse, the 100-year flood, and the design flow for along the downstream segments. Flow data are summarized in the table below.

CALCULATED FLOWS

Station	Mile	Delta (miles)	Attenuation	Cumulative	PULSE 3 Release	PULSE 2 Release	PULSE 1 Release	DESIGN FLOW	100-YR FLOOD
1055	105.4			100.0%	**9,000**	**7,000**	**5,000**	**2,350**	5,000
1031	102.9	2.5	3.8%	96.3%	8,663	6,738	4,813	2,350	9,100
1018	101.4	1.5	2.3%	94.1%	8,468	6,586	4,704	2,350	11,300
1004	99.8	1.6	2.4%	91.8%	8,264	6,428	4,591	2,350	15,600
989	98.1	1.7	2.6%	89.5%	8,054	6,264	4,474	2,350	17,600
974	96.6	1.5	2.3%	87.5%	7,872	6,123	4,374	2,350	18,700
935	92.4	4.2	6.3%	82.0%	7,376	5,737	4,098	2,350	18,900
856	84.8	7.6	11.4%	72.6%	6,536	5,083	3,631	2,350	19,100
820	81.8	3.0	4.5%	69.3%	6,241	4,854	3,467	2,350	18,300
805	80.4	1.4	2.1%	67.9%	6,110	4,753	3,395	2,350	17,700
805	80.4			67.9%	6,110	4,753	3,395	2,350	17,700
802	80.0	0.4	0.6%	67.5%	6,074	4,724	3,374	2,350	17,800
789	78.5	1.5	2.3%	66.0%	5,937	4,618	3,298	2,350	22,400
784	78.0	0.5	0.8%	65.5%	5,893	4,583	3,274	2,350	22,500
770	76.6	1.4	2.1%	64.1%	5,769	4,487	3,205	2,350	22,000
675	67.2	9.4	14.1%	55.1%	4,955	3,854	2,753	2,350	22,400
637	63.3	3.9	5.9%	51.8%	4,665	3,629	2,592	2,350	22,400

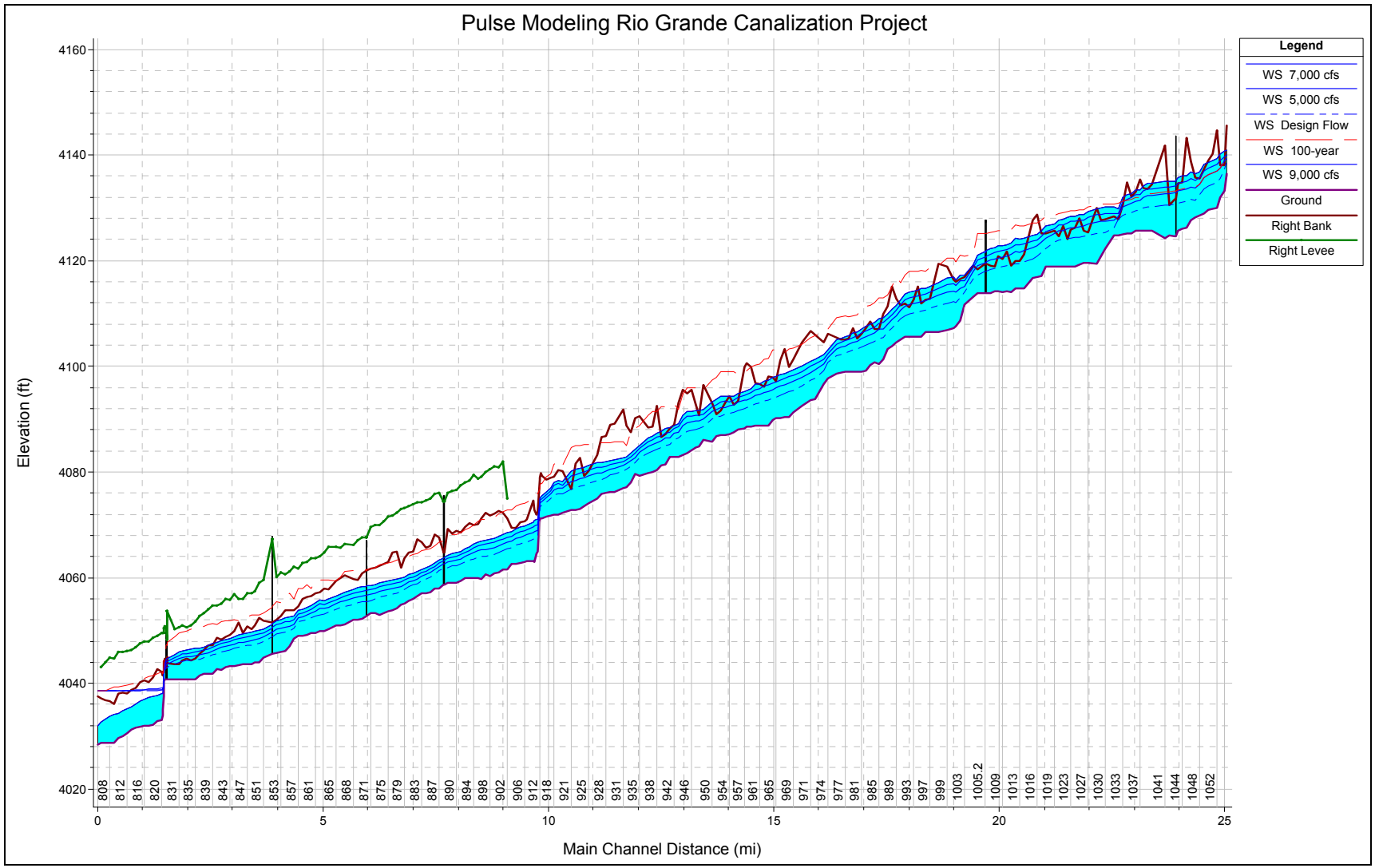
Modeling Results

Modeling was conducted for two stream reaches, from mile 105 to 80 (Percha Dam to the vicinity of Rincon Siphon), and from mile 80 to 63 (downstream to Leasburg Dam).

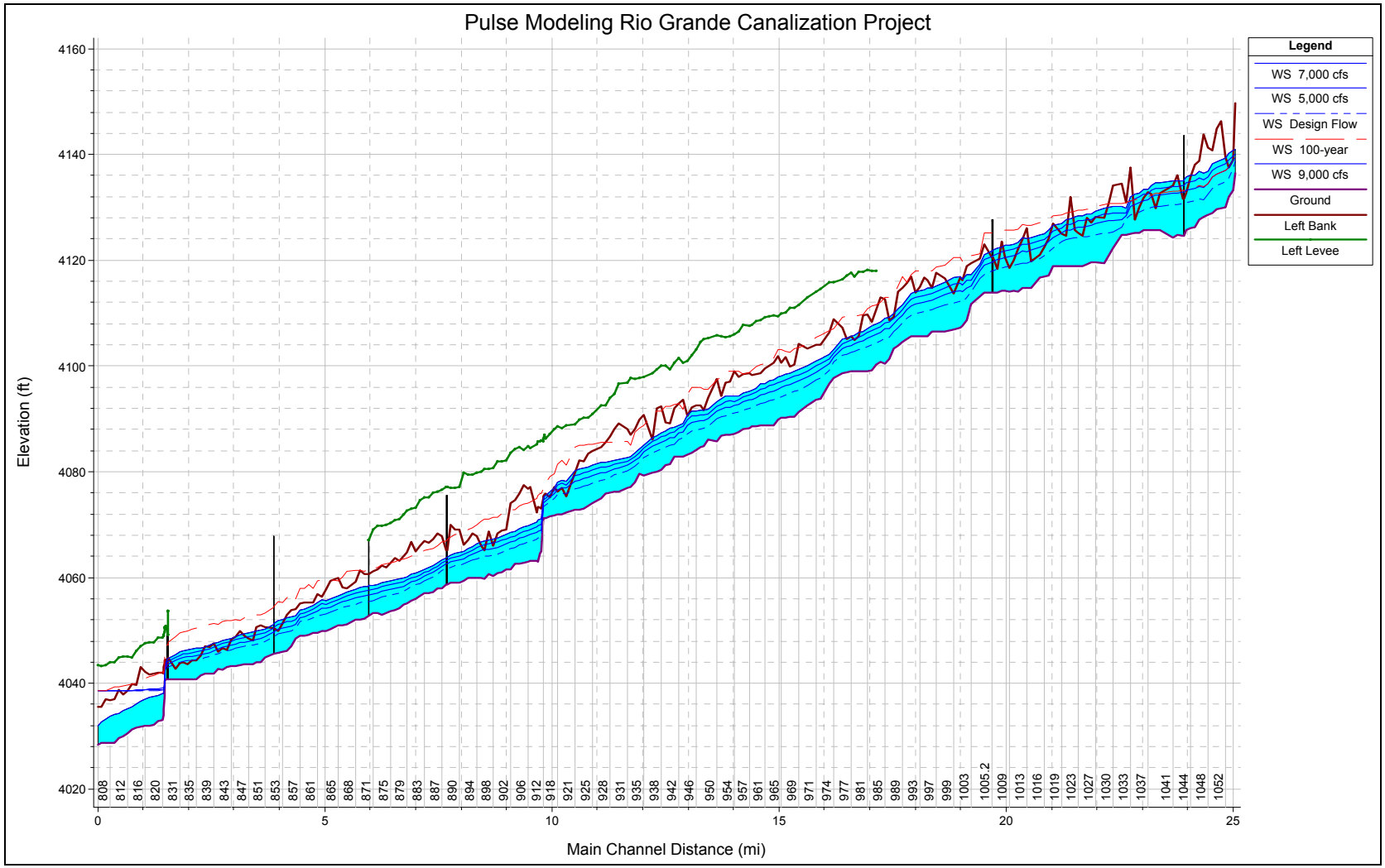
The following example illustrates results for the east side of the 80 to 63 mile segment. The fill-in area represents water depth for the 9,000 cfs pulse, calculated with an attenuation factor of 1.5 percent. Lines below represent the water levels for the 7,000 cfs and 5,000 cfs pulses, and for the design flow (dotted line). Water levels above the solid line, representing the channel bank, indicate overtopping conditions.

Elevations of the 100-year flood (dashed line), and top of the levee (solid line) are also indicated in the graph, above the channel bank.

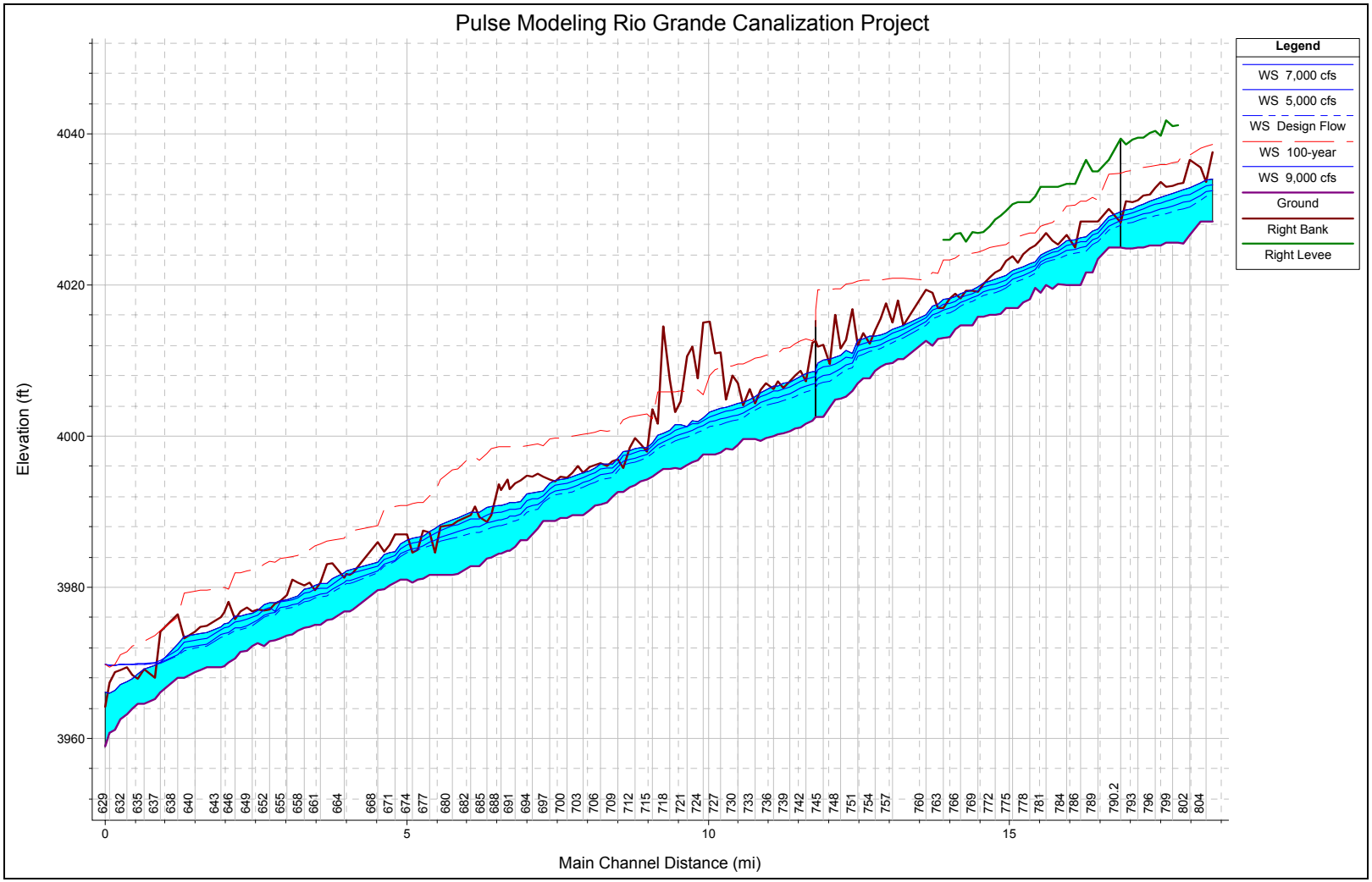
PULSE MODELING
RIGHT LEVEE, RIVER MILES 81-105



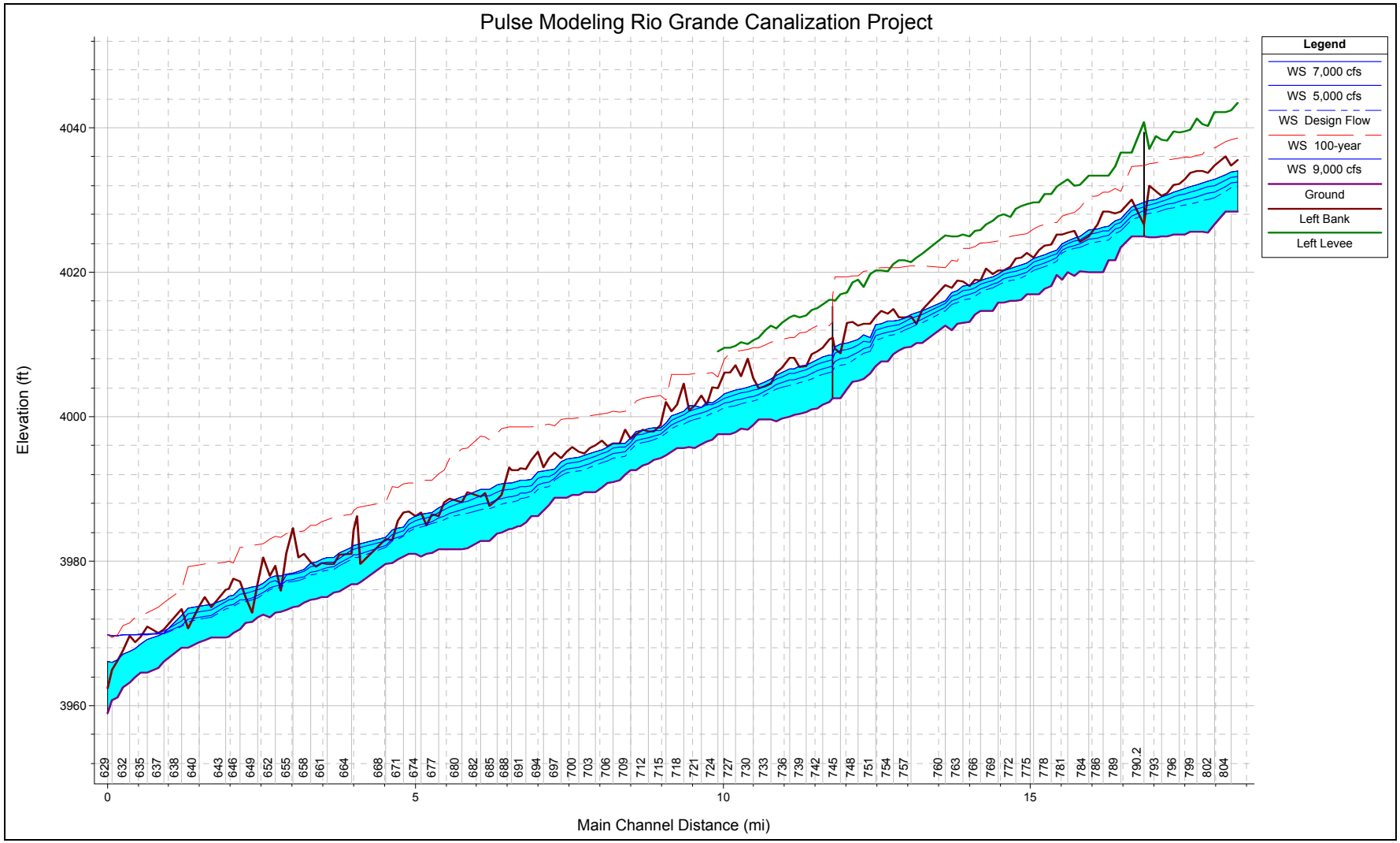
PULSE MODELING
LEFT LEVEE, RIVER MILES 80-105



PULSE MODELING
RIGHT LEVEE, RIVER MILES 63-81



PULSE MODELING
LEFT LEVEE, RIVER MILES 63-81



WORKSHOP FOR DISCUSSION OF
MODIFIED RESTORATION ALTERNATIVE
RIO GRANDE CANALIZATION PROJECT

Parsons Engineering Science, Inc.
October 22, 2001

DRAFT IMPLEMENTATION GUIDELINES

1) MANAGEMENT

- Restoration Committee coordinated by USIBWC (i.e. through Rio Grande Watershed Council).
- Actions to be implemented through adaptive management plan.
- USIBWC direct actions include funding of the council operation, breaching/removal of some sections of levees and acquire food easements; eliminating armoring near arroyos; reopening some meanders; extending drains along ROW to support riparian bosques; salt cedar control; gradually eliminating leases, mowing and dredging, in Rincon Valley.
- Actions by Watershed Council, others: secure water for irrigation/pulses; buy and manage lands outside ROW; erosion control in watershed; monitoring and technical evaluation of actions' success and limitations.

2) FLOOD CONTROL

- Combination of structural and non-structural measures.
- Remove levees at selected locations only to solve potential flood problems.
- Add easements to restrict placement of permanent dwellings where flood potential exists.
- Retain structural flood control south of Leasburg Dam and improve levees as indicated by modeling and results of levee evaluation program.
- Current modeling overestimates flood risk, but is acceptable for conceptual analysis. Two-dimensional models to be used in the future so that extent of pulses and overbank flow can be estimated more accurately to acquire easements.

3) WATER DELIVERIES

- Some inefficiency added. Potential tradeoff between in-channel losses vs. gains by salt cedar removal.
- Middle Rio Grande data usable as a reference for losses
- Gradually optimize timing/downstream use of pulses
- Coordinate with Lower Rio Grande Water Users Organization as regional water plan is developed

4) AGRICULTURAL TO PULSE IRRIGATION TRANSITION

- Initial tree cluster establishment (below drains first, starting from the upstream reach).
- Use initial years to secure water, monitor initial results.
- Initiate with small pulses to support and expand established vegetation, and increase as additional water is secured.
- Program based on cooperation primarily from EBID (use of their irrigation facilities).
- Secure water by irrigation efficiency, not decommissioning agriculture. Trade water gains in irrigation efficiency for water to be use in flood irrigation.

5) ROW LAND USE

- Begin development of riparian corridor below drains, and control salt cedar.
- Continue mowing to control salt cedar in non-planting sites
- Gradually discontinue leases and mowing as new areas within the ROW are targeted for development of native riparian vegetation.
- Discourage development in areas where levees maybe removed (work with local governments).
- Establish land acquisition fund to acquire floodable areas adjacent to ROW.

6) SEDIMENT MANAGEMENT

- Reduce sediment input by improved uplands management, not dams (cooperation agreements with BLM and NRCS)
- Gradually discontinue dredging in Rincon Valley: sediment recovery in Leasburg Dam.
- Select locations outside floodway for sediment disposal

ES ENGINEERING-SCIENCE, INC.

Client IBWC | Job No. | Sheet ___ of ___

Subject ALTERNATIVES WORKSHOP TARGETED RESTORATION | By | Date Oct 22

Checked | Rev.

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